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A THREE SIDED QUESTION.

Since there are three measurably distinct, and in some respects opposing, interests involved in the question of patent rights, there are naturally not less than three independent ways of regarding them. And it is equally natural that these opposing interests should now and then meet in open conflict.

There is first to be considered the interest of the community at large. Next in influence, though not in right, must be ranked the manufacturers and special users of inventions, such as railway companies and other great commercial or industrial corporations. Last in power, though first in beneficence, are the men of fertile brains and skillful hands to whom the world owes so much of its wealth, comfort, and civilization—the inventors.

The practical wisdom of the Fathers of our Republic was in no way more strikingly manifested than in their appreciation of the value of inventions. A new land gave rise to new necessities, and the prosperity of the country largely hinged upon the promptness and skill with which those necessities should be met. Accordingly they set a premium upon invention, and took pains to secure to inventors, at little cost, a property-right in the fruits of their creative genius.

The history of industrial and social progress in this country amply demonstrates the wisdom of the course adopted. Under a hundred years of encouragement, the inventors of the United States have added more to the power and prosperity of mankind than all the rest of the world during unnumbered antecedent ages. And that no peculiarity of race, or situation, or needs is to be credited with this rapid advancement in wealth and power is evident from the single circumstance that the same race, and other races of like development, have been colonizing new lands and creating new nationalities ever since history began. Other nations have been free; other nations have conquered wildernesses; other nations have built up great empires under new conditions. But no other nation ever offered such encouragement to invention, and in no other has invention progressed with such marvelous rapidity. Very naturally therefore the sound common sense of our people, notwithstanding the specious special pleading of doctrinaires and corporation lawyers, thoroughly approves of our patent system, and would rather increase than diminish the advantages it offers to inventors, confident that the evils attending the mild and self-limiting monopolies which patent rights create are insignificant compared with the enormous benefits the country has reaped and daily reaps from the privileges so conferred. Inasmuch as the normal and practical tendency of invention is to benefit the community—by improving and cheapening manufactures, by multiplying and bringing within easy reach of all a greater number and variety of articles of use and comfort, thus widening the scope and enjoyment of life—the community is necessarily bound to favor inventors and encourage their activity.

Not so the second class we have named. To them new inventions are not altogether beneficial. They have an enormous property interest in old inventions. Their profit comes from making and selling articles already in use, or from using processes already profitably applied. Every new device or improved process, particularly if of a high order of merit, is an immediate injury to them, unless they are free to appropriate it. It is a new and winning rival. To compete with it in open market is to invite defeat. They must either better the improvement, or pay for the use of it; and either alternative subjects them to trouble or expense or both together. What wonder, then, that not a few of this class are disposed to treat the inventor as a poacher upon their preserves; an interloper, not content to let well enough alone; a restless, troublesome fellow, who might be useful enough provided he would be controlled by them, but otherwise a very costly nuisance. What wonder, either, that they have a horror of *new* patent rights (they have less fault to find with those upon which their own wealth and prosperity have been founded), and are eager that the patent laws shall be so changed as to make it impossible for an inventor to keep them from enjoying the fruits of his genius and labor!

As for the last mentioned class, there can be no question that their interests lie, not less than those of the community at large, with those measures which secure to them the utmost freedom and encouragement consistent with the common rights of all: this as a right, not as a gratuity. More than any other class the inventors are the mainspring of modern material civilization. Unlike other producers, their contributions to the public wealth are actual creations. But in its first and essential condition the creation of the inventor is intangible. Not until it is translated into material form, and so brought to bear upon the physical and commercial realities of life, can it bring wealth to him; and then only in case he has the right to control it. To insure this translation and the consequent benefit to the community, the theory of our patent system has been that it is necessary to offer the inventor some assurance of property-right in the fruits of his invention: and the practical working of the system has amply demonstrated the correctness of the theory. The temporary monopoly which the patent right grants to the inventor has unquestionably secured the practical application of myriads of useful ideas which would otherwise have died with the minds which harbored them, or still more speedily have passed into the oblivion of forgetfulness; while the temporary restraints which such monopolies have imposed upon others, and the public disadvantages incident thereto, have been infinitely outweighed by the preponderance of the system's good effects.

The recent history of the civilized world has shown the greatest progress to be coincident with the greatest encouragement of invention. To withdraw the direct results of such encouragement, in the past, would be to take away four fifths of our power as a people, four fifths of all that we specially prize and delight in, four fifths of all that goes to make modern civilization higher, more enjoyable, more secure, and more promising for future good, than any that has gone before it: and what has proved so beneficial in the past is not likely to prove less so in the future.

It is a serious question, therefore, whether our legislators shall be allowed to withdraw, at the instance of the short-sighted selfishness of special classes, any portion of the protection and encouragement which our inventors have hitherto enjoyed. To recur to a figure already used, the country cannot afford to break, or even weaken, the mainspring of its material progress.

THE LIQUEFACTION OF AIR AND ALL THE PERMANENT GASES.

Matter exists in the three forms, solid, liquid, and gaseous, and is in all these states supposed to consist of molecules which are never at rest but which always possess a movement or vibration of their own. In the solid state the molecules vibrate about fixed positions from which they are prevented by the force of cohesion from departing, and which movement does not interfere with the shape of the body. In liquids the fixed positions are absent, and the molecules while still affected by the force of cohesion are free to move and rotate about themselves. In gases the molecules are altogether freed from their mutual attraction and follow the ordinary laws of motion. When they meet they repel each other, and thus a gas will expand indefinitely unless inclosed in an envelope.

Under certain conditions of heat all substances in nature are capable of assuming these states. When heat is imparted to a solid the motion of the molecules is accelerated until the limit of such motion is reached, which allows the body to remain in solid form. Further elevation of temperature determines the passage of the substance to the liquid form, and ultimately to the gaseous state. Still further application of heat after this last condition has been assumed increases the velocity of molecular motion, and causes the molecules, if in a closed vessel, to resist greater pressure, or under the same pressure to resist that pressure over a greater area; hence follows the phenomenon of the expansion of gases. Now, if the temperature be indefinitely raised or the volume of space indefinitely increased under a constant temperature, the vapor or gas will finally approach a state corresponding to that of a perfect gas, that is, one which possesses the condition of perfect fluid elasticity and presenting under a constant pressure a uniform rate of expansion for equal increments of heat. The conditions, however, of an absolutely perfect gas cannot be attained, because all gases change their physical state when the molecular movement of their particles is modified. And this modification may be effected in two ways. First we may reverse the operation above detailed and abstract heat, producing just the reverse result to that noted, or, second, we may overcome the motion of the molecules by actual compression. That by these means presumably permanent gases could be liquefied was demonstrated by Faraday in 1823, but he is said to have been anticipated by Monge and Clouet in the condensation of sulphurous acid in 1800, and by Northmore, who liquefied chlorine in 1805. The simple apparatus used by Faraday consisted of a bent glass tube having a long and a short leg at right angles. In the open end of the longer portion was placed a substance from which gas could be obtained by heat, after which the tube was hermetically sealed. The shorter leg was then plunged into a freezing mixture and by the application of heat to the long leg large quantities of gas were produced which through being confined in very small compass was subjected to its own pressure and to the reduction of temperature by the freezing mixture until finally the liquid form was assumed. Faraday in this manner liquefied chlorine and several other gases supposed to be permanent, and demonstrated the truth that between vapor and gas, the one being transformable into liquid, the other not, no difference exists, or, more broadly, that the three states of matter, liquid, solid, and gaseous, are not specific to any form of matter, but solely depend upon the mode of motion of the molecules of the substance.

A few weeks ago, to have stated this law thus broadly would have been to neglect an apparently very important exception, namely, that six gases had persistently refused to be governed by it; and although, theoretically, it was impossible to except them, still, practically, the ingenuity of chemists and physicists had failed in all attempts to reduce them to actual conformity to the law. Six gases—hydrogen, oxygen, nitrogen, nitric oxide, marsh gas, and carbonic oxide—had resisted all efforts to liquefy them. Records of tests of this kind are not wanting; and among the most elaborate experiments are those made by Dr. Andrews, and described by him before the British Association in 1861. He used the elastic force of the gases evolved in the electrolysis of water as the compressing agent, and subsequently mechanical means. The gases were compressed in capillary tubes and then subjected to the cold produced by the carbonic acid and ether bath. Atmospheric air was compressed by pressure alone to $\frac{1}{371}$ of its original volume, and by the united action of pressure and a temperature of —106° Fah. to $\frac{1}{675}$, in which state its density was little inferior to that of water. Oxygen was reduced to $\frac{1}{324}$ of its volume by pressure, and by pressure and cold to $\frac{1}{554}$; hydrogen by cold and pressure to $\frac{1}{278}$; carbonic oxide by same to $\frac{1}{278}$; and nitric oxide to $\frac{1}{680}$. Yet it is stated that none of these gases exhibited any appearance of liquefaction. Berthelot also made experiments in the same direction in 1850, and, by means of the expansion of mercury, subjected oxygen, nitric oxide, and carbonic oxide to immense pressures. He concludes "that pressure alone is not capable of effecting the liquefaction of gases under certain conditions of temperature," but suggests that better results may possibly be obtained by the aid of powerful refrigeration. Natterer of Vienna has also made valuable experiments in the same line.

Within the last few weeks the problem which for more than half a century has defied all experimenters has been solved. Almost simultaneously, yet by different methods, the liquefaction of the supposed permanent gases has been accomplished by Raoul Pictet, of German Switzerland, and M. Cailletet, in Paris. M. Cailletet's apparatus consists of a massive steel cylinder with two openings, through one of which hydraulic pressure is communicated. A very strong small tube passes through the other and is inclosed in a freezing mixture. It opens within the cylinder into a second smaller cylinder serving as a reservoir for the gas to be compressed. The remaining space in the large cylinder is occupied by mercury. The gas is compressed into the small tube and then suddenly placed in communication with the atmosphere, when its expansion causes its intense refrigeration.

The original announcement of M. Pictet's discovery is given in another column. The following details are given in *Nature:*

M. Pictet uses four vacuum and force pumps, similar to those used for making ice in his ice machine (which we recently illustrated), driven by an engine of 15 horse power. Two of these are employed in procuring a reduction of temperature in a tube about four feet long containing sulphurous acid. With the pumps at full work there is a nearly perfect vacuum over the liquid and the temperature falls to —85° or —94° Fah. M. Pictet uses this sulphurous acid to cool the carbonic acid after compression, as water is used to cool the sulphurous acid after compression. This is managed as follows: In the tube thus filled with liquid sulphurous acid at a temperature of —76° Fah. there is another central one of the same length but naturally of smaller diameter. This central tube M. Pictet fills with liquid carbonic acid at a pressure of four or six atmospheres. This is then let into another tube 12·8 feet long and 1·2 inch in diameter. When thus filled the liquid is next reduced to the solid form and a temperature of —220° Fah., the extraction of heat being effected as before by the pump.

Now it is the turn of the oxygen. Just as the tube containing carbonic acid was placed in the tube containing sulphurous acid, so is a tube containing oxygen inserted in the long glass tube containing the now solidified carbonic acid. One end of this tube is connected with a strong shell containing chlorate of potash; the other end is furnished with a stop-cock.

When the tube was as cold as its surroundings, heat was applied to the chlorate, and a pressure of 500 atmospheres was registered; this descended to 320. The stop-cock was then opened, and a liquid shot out with violence. Pieces of lighted wood held in this stream spontaneously inflamed with tremendous violence.

M. Cailletet first introduced pure nitrogen gas into the apparatus. Under a pressure of 200 atmospheres the tube was opened, and a number of drops of liquid nitrogen were formed. Hydrogen was next experimented with, and this, the lightest and most difficult of all gases, was reduced to the form of a mist at 280 atmospheres. The degree of cold attained by the sudden release of these compressed gases is scarcely conceivable. The physicists present at the experiment estimated it at —508° Fah.

Although oxygen and nitrogen had both been liquefied, it was deemed of interest to carry out the process with air, and the apparatus was filled with the latter, carefully dried and freed from carbonic acid. The experiment yielded the same result. On opening the tube a stream of *liquid air* issued from it resembling the fine jets forced from our mod. ern perfume bottles.

M. Cailletet reports the liquefaction of nitric oxide at 146 atmospheres, and at +12° Fah.; the details relative to the other gases are not yet at hand.

The discoveries of MM. Pictet and Cailletet are of the highest importance, both as adding still further confirmation to the dynamic theory of heat, and as opening the way to new studies into the nature of our atmosphere. They will also tend to induce further examination into Professor Graham's inference of the existence of hydrogen in solid form—a substance which he named hydrogenium—believed to exist in an alloy with palladium, and the density of which he calculates to be 0·733. As it appears clearly from the records of the experiments now at hand that refrigeration—as Berthelot predicted—has more to do with liquefaction than compression, it would seem possible to find a limit for our atmosphere, which could not exist in gaseous form if suddenly dispersed in planetary space. The idea is suggested that a boundary may exist at which, through the intense cold, air is always liquefying, falling, revaporizing, and thus a circulation is constantly taking place.

WHILE this winter may yet be very cold, Professor Smyth's predictions to that effect thus far are hardly verified.

MYSTERIOUS EXPLOSIONS.

A singular explosion occurred in a candy manufactory in this city about a month ago. We adverted to this last week, giving a correspondent's theory, and pointing out that fire officials and other authorities had reached no definite conclusion as to its cause. Investigation as to the inflammable or explosive material in the manufactory has shown that there was chlorate of potash, a small amount of fulminate, used for the making of snap crackers, and a large quantity of starch, from which material moulds are made for candy. These moulds, it appears, after being charged with syrup, are put in a drying room, which is highly heated. And it is stated that in previous fires in candy manufactories, when the flames have reached this room, explosions have occurred. Starch also was probably present in several of the work rooms in the form of fine dust, owing to its being used in this condition in some of the manufacturing processes.

It seems to us that here are quite sufficient data to base a reasonable theory as to the cause of the catastrophe. It may be assumed that accidental conditions were such as to ignite the chlorate of potash or the fulminate, which last would explode with terrific violence, and that thereby the powdered starch in the rooms became fired and also exploded; or the circumstances may be reversed, as it is quite as reasonable to suppose that the starch, being highly explosive in its comminuted state, blew up first, constituting the major explosion, which subsequently involved the chemicals. The examination of the details of many other mysterious explosions fortifies us in the belief that the finely pulverized starch lies at the bottom of this one.

Two years ago just such a casualty occurred in the Pullman Car Works at Detroit. There all the sawdust and shavings from the wood-working machines were taken by exhaust blast into a pipe and forced to the furnaces, where they were consumed. When it was not desired to direct the material into the furnace, communication therewith was closed and a grating prevented the escape of the dust, etc. from the cupola in the roof, to which it was conducted. While cleaning this receptacle the workmen discovered its contents to be on fire, sparks having been drawn in from the furnace. A stream of water was thrown in, but the instant this was done a tremendous explosion ensued, killing 13 men and destroying the adjacent portions of the building. Two months prior to this casualty a similar one occurred at the works of the Milburn Wagon Company at Toledo, where the fine wood dust in a shaft exploded, causing extensive destruction.

Much further evidence can be adduced to show that just as ordinary illuminating gas is liable to explode when mixed with air in the right proportion, so will the dust of any inflammable material. A sawdust explosion occurred four years ago in the town hall of Friedele, Germany. At the Ofen-Pesth (Austria) steam mill a terrific explosion was caused by a cloud of dust of some very fine varieties of flour being ignited by a candle. In 1872, at Glasgow, a flour explosion was caused by sparks from the millstones. Professors Rankine and MacAdam investigated the subject, and found that the rapid combustion of the finely divided flour, as well as the ignition of a mixture of air with the gases furnished by the decomposition of flour and of wood, may produce explosions. Flour and bran mixed gave off at 450° Fah. a gas which, mingled with nine times its volume of air, ignites; and such a temperature may be obtained by friction in the grinding process, or, as might have been the case in the Barclay street disaster, by actual contact of the dust-laden air with a light.

Flour, bran, starch, sawdust, all belong to the same category in this respect. The correspondent whose letter we published last week states that finely pulverized cork in air is also explosive, and that it caused a similar disaster at the Linoleum Company's factory on Staten Island, where it is used in the manufacture of floor covering. In the Grahamite mines of West Virginia an explosion was caused by a dry, resinous, brittle material filling the mining shaft in the form of impalpable dust, which it was afterward found could not be entered with impunity without safety lamps.

We do not doubt but that conditions for explosions of this kind, as well as those tending toward slow spontaneous combustion, often exist over long periods of time in manufactories without the immediate cause of disaster happening to come into action. Probably the rooms in this factory had been filled with starch dust day after day for years, just as rooms in other candy factories now are; but the combining proportions might not have been exactly right, or the misopportune spark might not have been applied. So also in wood-working shops. Under the flooring of many we dare say there are abundant accumulations of sawdust and shavings—perhaps steam pipes are imbedded in this refuse. Inspection may reveal no immediate apprehension of danger, but a few drops of oil may trickle in upon the mass, rapid oxidation may be caused, and a disastrous fire or explosion may ensue. The ounce of prevention in such cases would be worth many pounds of cure.

NOTES OF PATENT LAW DECISIONS.

OF THE COURTS.

In Reissner *vs.* Auness, the suit was brought against the defendant for infringement of certain letters patent, No. 7,751, reissued to John A. Fray, June 19, 1877, for "improvements in coal oil stoves," to which the defendant put in a plea embracing three distinct defenses, namely: 1. That the reissue to Fray was unlawful, because he had previously obtained a patent in Canada for the same invention, granted May 15, 1873, for the term of five years, and the reissue in question was not limited to expire at the same time with the foreign patent. 2. That new matter was introduced into the reissue which was not shown and described in the original patent. 3. That for the purpose of deceiving the public the description in the reissued letters patent was made to contain less than the whole truth relative to the alleged invention. The plea or pleas were set down for argument, and the first question raised was whether the same were not bad for duplicity. The counsel for the defendant insisted that they were not, because, although three distinct matters were alleged against the right of the complainant to recover, they all related to a single defense—to wit, the invalidity of the complainant's patent. The court held that the plea was bad for duplicity, as the several matters, although relating in a general way to but a single defense, namely, the invalidity of the complainant's patent, were essentially independent of one another, and by their retention destroyed the very office of the plea, which was to secure singleness in the issue. The court therefore ordered that the pleas as filed might be set down as an answer at the option of the defendant, or that the defendant might elect within a specified time which of the several grounds of defense he would stand on, and that the other grounds be overruled.

The case of the Gould's Manufacturing Company *vs.* Cowing came up on exceptions taken by the defendant to the report of the master under the interlocutory decree directing an accounting upon the infringement of the plaintiff's patent. The invention was one only of an improvement in a pump, and not of the entire pump. Numerous parts of the pump were in general use prior to the grant of the complainant's letters patent, and were not claimed therein, and were free to be used by the defendant. The patented invention claimed was a special construction of a side chamber, whereby the same was adapted to use with valve casings bolted on the outside. Held: That the damages could not exceed the profits upon such improvement, and that upon the failure of the complainant to show the profits or damages arising from the use of the improvement, the master should decide that nominal damages only could be recovered; and that it was not sufficient for the complainant to show that wherever the particular patented improvement was introduced other kindred devices could not be sold.

OF THE PATENT OFFICE.

The interlocutory appeal in the matter of the application of Henry Law for letters patent for "improved window blind actuator" has been decided adversely to the applicant.

The claim was for two independent results produced by two independent mechanisms, namely, a device for opening and closing window blinds and a device for locking and unlocking the blinds.

Rule 15 of Office Practice authorizes the claiming of two distinct devices in one application where they are "dependent upon each other and mutually contribute to produce the new result." The question to be determined in the case, therefore, was: Had the applicant combined the two devices so that the operation of each contributed, either simultaneously or successively, to a unitary result?

It appeared that not a single part of the mechanism for opening and closing the blinds was described as affecting the operation of any part of the locking mechanism, nor was the latter dependent on the former in any respect whatever. Both mechanisms performed precisely no other function, when used together on one window, than when used separately a thousand miles apart. The Commissioner held that there was not such an intercommunication of parts or mutual dependence of the distinct devices to entitle them to be incorporated in the same application.

In the interlocutory appeal of Howland, lately decided, the practice of the office in regard to the admissibility of several specific devices embodying the same general features of construction in a single application is laid down as follows: Whenever a generic claim can be predicated which is good in view of the state of the art, and which will include the modifications or specific devices described or exhibited in the drawings, then these may all be retained in a single application; for it is manifest, from the fact that the claim applies with equal aptitude to each, that there are generic features of identity which indicate the same basis of invention. On the other hand, where no claim of the character indicated can be maintained, it is equally true that there is such diversity as will require a division of the application, this restriction being pursued until the matter retained in a single case can be safely said to relate to but one invention, or, in other words, can be contained in the broadest patentable claim that is capable of being drawn to it.

A New and Easily Cleansed Filter.

Filters are liable to become choked with the material which they collect, especially where water is filtered before use in a steam boiler, and the result is that the supply through the stoppage of its conduit is materially diminished. Messrs. Ralph S. Jennings and Norman G. Kellogg have recently patented, both in this country and abroad, an ingenious device which they claim entirely obviates the above mentioned trouble. The filter is provided with a valve and a series of pipes by means of which hot water may at any time be conveyed through the filter. The water enters at the discharge end and passes through to the supply end, where it escapes to a pipe leading to the sewer. The hot water dissolves the various salts hitherto held in solution by the cold water, and mechanically removes all solid matter from the charcoal filling.